

## How light travels through space / Why we can see the sun and the stars

There is a worthy question which arises often in our yoga sessions. The question is: “If shabda is the only tanmātra which can move through ākāsha tattva, then how are we able to see the light of the sun and the stars? How do we see the stars in the sky at night, and the sun in the day? That light has to travel through space to get to us.”

The first thing to understand here is that whereas shabda is a tanmātra, light is not. Light is a tattva -- i.e. tejastattva -- one of the five tattvas of which the universe is made. The five are ākāshatattva, vāyutattva, tejastattva, jalatattva, and kṣītītattva. These are the five substances (tattvas) of which the world (i.e. the universe) is comprised. Whereas, shabda is not one of these, but is rather one of the five tanmātras. Tanmātras are small quantum of information which are grasped by the indriyas of the body, and these tanmātras require a medium or vehicle by which to travel. For example, the smell of a flower is gandha tanmātra, and travels to our nose via the particles of pollen in the flower which float up into the air. As a tanmātra, shabda-tanmātra needs a medium or vehicle by which it can move; as the subtlest of the five tanmātras (shabda, sparsha, rūpa, rasa, gandha) shabda-tanmātra can travel in any of the five tattvas mentioned above, from ākāsha to kṣīti.

In contrast to shabda, which is a tanmātra and needs a medium through which it can move, light is not a tanmātra but is itself a tattva. As such, it does not require a medium or vehicle by which it can move. Rather, being a tattva it is itself a medium for the conveyance of tanmātras--- specifically rūpa-tanmātra, sparsha-tanmātra, and shabda-tanmātra. In space or antarikṣa, there is ākāsha tattva. But along with ākāsha tattva, tejastattva can also be there, and it can move freely there-- independent of ākāsha-tattva. Tejastattva -- being a tattva rather than a tanmātra -- does not depend on any other tattva for its movement. Tejastattva and ākāshatattva coexist in the antarikṣa and there is no sort of clash or conflict between them.

So light travels through space, but space is not the medium for that travel; light does not require any medium. Rather, it is itself a medium.

Indeed, if we are going to say that light needs a medium through which to travel, then just as we had no explanation for this phenomenon in space/antarikṣa from a yogika perspective, so we have the same problem in one's own room: looking at a lit light bulb, or at a clock on the wall. We have learned that vayu-tattva is a medium for shabda and sparsha, not for tejas which is itself a tattva. So from this perspective, we have no explanation for how light can travel from the light bulb to your eye, or from the clock to your eye. Actually, light does not require a medium; it is its own tattva and can travel anywhere so long as it is not blocked by something solid like a wall or a door.

So light travels from the light bulb, from the clock, as well as from the sun and from other stars to our eye, and brings with it rūpa-tanmātra so we can see what these things look like. It is the rūpa-tanmātra which requires a medium to convey it. The rūpa or form of the stars/moon/sun is conveyed to our eye, through the distance of space, via tejas-tattva. Not via ākāsha-tattva.

This is the explanation using the principles of yoga. Looking at it from a modern scientific perspective I think it is consistent. As we know in science, although sound and light are both waveform in nature, they are not in the same category of waves. Light comes in the category of EM (electromagnetic) waves. The waveforms which fall within the visual spectrum of EM waves are known as light. Also included in the EM spectrum are xrays and ultraviolet waves. But sound is not in this spectrum; although a waveform, it is not in the EM category of waves. Being in different categories of waves, sound and light travel in different ways.

Scientifically speaking, sound requires a medium for its travel. An initial sound vibrates the molecules of a given medium, such as air. And those molecules in turn vibrate the molecules of air close to them, and it continues as a sequence with vibrated molecules in turn vibrating the adjacent ones until the molecules of air which are close to your ear get vibrated. In this way sound is conveyed-- whether the medium is air, water, solid, or fire. All these can convey sound and they do so in a sequential fashion-- as with the example of a rope. If the ends of a length of rope are each held by two people, and if one person shakes their end of the rope,

then the wave thus initiated travels along the rope in sequential fashion, with one part of the rope vibrating the next, until the wave reaches to the other person. And this is how sound travels through media. (If the rope is condensed theoretically to a single point, it will not be able to convey its wave anywhere.)

In contrast, light does not move in this way. Light is its own medium. Rather than vibrating the molecules of say air or water in sequence as in the example of the rope, light is its own medium for travel; it requires no other medium. Now, it may be blocked (reflected) or bent (refracted) depending on the characteristics of objects with which it comes in contact in its path; but light is its own path. And being its own medium (tattva), it is itself a medium for conveying the quality of form (rúpa). Only when light is present do we get to see what something looks like.

Here is another way to understand the difference between the travel of light and sound: When light travels across space (outer space, antarikśa), it does not light up the space. The space remains black. Just the light is traveling there, but not using the space as a medium for the travel. Whereas if sound is travelling in a medium, as the medium is a vehicle for the travel the sound will be audible all along the way. For example, if Ráma calls out to Shyáma across a field, the sound will not only be audible at the endpoint i.e. when it reaches Shyáma, but it will be audible at any interval point in between the two persons.\*

I think the yogika explanation of 5 tattvas, 5 tanmátras, and 5 indriyas is working here well. It explains why light travels from the sun to the earth, without lighting up the space in between. These yogic principles furthermore allow for explanation of mind and consciousness, things which modern science is ill equipped to address.

(\*That would only be the case for light if there were something in its path to block/reflect it. In the case of light, we have to consider the principles of reflection and refraction. Light hits a door and is reflected, so we can see the door but not that which is beyond it. Light hits the surface of water and is partially reflected, partially refracted. So we can see the surface of the water, and we can also see what is three feet down in the water if the water does not contain other

contaminants or materials. But the air or water are not required as media for light to travel in. Light travels freely through space, independent of ákasha-tattva.)

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